a CO oxidation unit for further decreasing CO contained in the resultant reformed gas, that was treated in said shift reaction unit, by oxidation; and

said reforming reaction unit and said shift reaction unit containing different catalysts, said shift reaction unit and said CO oxidation unit being indirectly heated by heat transfer from the heat source of said raw material reforming unit, said CO oxidation unit being positioned outside said reforming reaction unit, and said reforming reaction unit being directly heated by said combustion unit so that the temperature in said reforming reaction unit is controlled in the range of 400 to 1000°C, said shift reaction unit being indirectly heated by heat transfer from said combustion unit so that the temperature in said shift reaction unit is controlled in the range of 200 to 350°C, said CO oxidation unit being indirectly heated by heat transfer from said combustion unit so that the temperature in said CO oxidation unit is controlled in the range of 100 to 250°C.

REMARKS

Upon entry of this amendment, claims 12, 18 and 30 will be amended, whereby claims 1-30 will remain pending. Claims 1, 12, 18, 20 and 30 are independent claims.

Reconsideration and allowance of the application are respectfully requested.

DISCUSSION OF MARCH 13, 2001 AND APRIL 25, 2001 INTERVIEWS

Applicants express appreciation for the courtesies extended by Examiners Varcoe and Tran during telephone interviews of March 13, 2001 and April 25, 2001 in connection with the above-identified application.

Applicants note that during the March 13, 2001 telephone interview the premature finality of the Office Action was discussed. The Examiner agreed that the finality of the office Action was premature and withdrew the finality. The withdrawal of the finality of the Office Action to a Non-final Action is indicated in the Interview Summary, and the Examiner confirmed during a telephone call that the computer system at the Patent and Trademark Office indicated that the action was a non-final action.

During the April 25, 2001 telephone interview arguments were presented concerning the allowability of the pending claims that are rejected over the prior art. The arguments as presented during the interview are included in the remarks below.

RESPONSE TO FORMAL MATTERS

Applicants express appreciation for the inclusion in the Office Action of the initialed copy of the Form PTO-1449, whereby the Examiner has confirmed consideration of the Patent Abstracts of Japan, Vol. 1996, No. 08, August 30, 1996.

The objection to the drawings as containing non-English text has been withdrawn. Therefore, it appears that the drawings filed February 8, 1999 are approved. Accordingly, it appears that formal drawing requirements have been complied with in this application, and no further action is required on the part of Applicants with respect to submission of formal drawings.

Applicants also acknowledge the withdrawal of the objections to claims 4 and 30.

Response to Rejection of Claims 12-18 and 30 Under 35 U.S.C. 112, Second Paragraph

In response to the rejection of claims 12-18 and 30 under 35 U.S.C. 112, second paragraph, Applicants respectfully submit the following.

In this ground of rejection, it is contended that the claims are indefinite in the use of certain terminology. In response, Applicants have amended the claims herein to even more clearly recite Applicants' invention. In this regard, Applicants note that the amendments herein are intended to clarify claim language, and are not intended to be construed as narrowing amendments made in response to a statutory rejection.

Applicants therefore respectfully request that the rejection of the claims under 35 U.S.C. 112, second paragraph, be withdrawn, with allowance of all the pending claims.

Response to Indication of Allowable Subject Matter and the Rejection over MURRAY et al. In View Of TANIZAKI

In response to the indication of allowability of claims 2-10, 19 and 20-23, the indicated allowability of claims 12-18 if amended in view of the 35 U.S.C. 112, second paragraph, rejection, and the rejection of claims 1-11 and 24-30 under 35 U.S.C. 103(a) as being unpatentable over MURRAY et al. (hereinafter "MURRAY"), EP 0 199 878, in view of TANIZAKI, JP 07-126001 A, Applicants respectfully submit the following.

Applicants express appreciation for the indication of allowability of claims 2-10 and 12-23. However, for the reasons set forth below, Applicants respectfully submit that each of the pending

claims should be indicated to be allowable over the prior art, and an early indication of the allowability of each of the pending claims is respectfully requested.

Applicants respectfully submit that the prior art does not teach or suggest Applicants' invention as disclosed and claimed. In this regard, it is noted that Applicants' independent claim 1 is directed to a reforming apparatus comprising an integrated structure of three separate units, comprising:

a raw material reforming unit for steam-reforming a raw material to be reformed and producing a reformed gas containing hydrogen as a principal component, including a heat source that generates heat by combustion of a fuel gas, operable to directly obtain heat for the steam reformation reaction from said heat source;

a shift reaction unit for decreasing, by water-gas-shift reaction, CO contained in the reformed gas produced in said raw material reforming unit; and

a CO oxidation unit for further decreasing, by oxidation, CO contained in reformed gas treated in said shift reaction unit; and

said raw material reforming unit and said shift reaction unit contain different catalysts, and said shift reaction unit and said CO oxidation unit being arranged in a manner that said shift reaction unit and said CO oxidation unit can be indirectly heated by heat transfer from the heat source of said raw material reforming unit, and further said CO oxidation unit including an outside surface, and being arranged to obtain atmospheric cooling of the outside surface.

Still further, Applicants' independent claim 30 is directed to a reforming apparatus comprising an integrated structure of four separate units, which comprises:

a combustion unit for generating heat by combustion of a fuel gas;

a raw material reforming reaction unit for steam-reforming a raw material and producing a reformed gas containing hydrogen as a principal component;

a shift reaction unit for decreasing CO contained in the reformed gas, that was produced in said raw material reforming unit, by water-gas-shift reaction; and

a CO oxidation unit for further decreasing CO contained in the resultant reformed gas, that was treated in said shift reaction unit, by oxidation,

at least two units, said reforming reaction unit and said shift reaction unit containing different catalysts, said shift reaction unit and said CO oxidation unit being indirectly heated by heat transfer from the heat source of said raw material reforming unit, said CO oxidation unit being positioned outside said reforming reaction unit, and said reforming reaction unit being directly heated by said combustion unit so that the temperature in said reforming reaction unit is controlled in the range of 400 to 1000°C, said shift reaction unit being indirectly heated by heat transfer from said combustion unit so that the temperature in said shift reaction unit is controlled in the range of 200 to 350°C, said CO oxidation unit being indirectly heated by heat transfer from said combustion unit so that the temperature in said CO oxidation unit is controlled in the range of 100 to 250°C.

In contrast to Applicants' disclosed and claimed invention, it is noted that the rejection utilizes the disclosure of TANIZAKI in order to modify the hydrocarbon fuel reformer of MURRAY to include a CO oxidation unit in an attempt to arrive at the structure recited in Applicants' claims, including the CO oxidation unit and its placement with respect to the remainder of the structure as recited in Applicants' claims. However, Applicants respectfully submit that one having ordinary

skill in the art would not have been motivated to modify the hydrocarbon fuel reformer of MURRAY in the manner asserted in the rejection. In particular, MURRAY discloses, at page 11, lines 30-37, that although the entire shift reaction cannot be performed within shift reaction chamber 60, a sufficient portion of the reaction can be achieved therein that the size of the external shift reaction device 104 can be substantially reduced. MURRAY further discloses that since about 30 to 40% of the shift reaction is accomplished within shift reaction chamber 60, the external shift reactor can be correspondingly reduced in size.

From the above, it is apparent that MURRAY discloses that the shift reactor is at least partially externally positioned from the main reactor. Therefore, even if one were to add a CO oxidation unit to the hydrocarbon fuel reformer of MURRAY, it would not be situated in a manner as recited in Applicants' claims, but would be positioned at a location after shift reactor 104 in MURRAY. Thus, whether is not it would have been obvious to combine the disclosures of MURRAY and TANIZAKI, the instantly claimed invention would not be at hand.

During the above-noted April 25, 2001 telephone interview, the above arguments were set forth, with it being emphasized that it is apparent that MURRAY discloses that the shift reactor is at least partially externally positioned from the main reactor. Therefore, it was argued that if one were to add a CO oxidation unit to the hydrocarbon fuel reformer of MURRAY, the CO oxidation unit would be positioned after the external shift reactor 104 in MURRAY, and not after the first shift reactor 60.

The Examiners basically asserted in response to the above arguments that the rejection does not have to rely on all disclosure in a reference, but can pick and choose the disclosure that is utilized

in a rejection. Of course, this assertion is improper, and the totality of the disclosure of a document must be utilized. In this regard, Applicants argued during the interview, and present that argument herein, that removal of the first shift reactor from the disclosure of MURRAY would essentially destroy the disclosed apparatus for hydrocarbon fuel processing disclosed by MURRAY which discloses the first shift reactor as a part of the MURRAY system. In this regard, a prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. W.L. Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984). Thus, the overall teachings of the prior art must be considered.

The Examiner also argued during the interview that the CO oxidation unit of TANIZAKI could be located after the first shift reactor 60 of MURRAY. In response, Applicants respectfully submit that TANIZAKI discloses that the CO oxidation unit is positioned after the shift reactor, and Applicants' claims also recite that the CO oxidation unit is positioned after the shift reactor. In such an instance, even if the disclosures of MURRAY and TANIZAKI were combined, the CO oxidation unit would be positioned after the external shift reactor 104 of MURRAY, and not after the first shift reactor 60. Moreover, the external shift reactor 104 of MURRAY does not include a heat source. Therefore, following the disclosures of MURRAY and TANIZAKI, it would not have been obvious to having ordinary skill in the art to arrange a CO oxidation unit so as to be indirectly heated in MURRAY.

Still further, TANIZAKI does not disclose the CO oxidation unit to be arranged in such a way that an inside surface is arranged to be indirectly heated by heat transfer from the heat source of the

raw material reforming unit and an outside surface of the CO oxidation unit is arranged to obtain atmospheric cooling of the outside surface. This arrangement of the CO oxidation unit improves the efficiency of CO oxidation reaction.

Moreover, for space considerations, a CO oxidation unit would not be placed after each of the shift reactors of MURRAY.

Still further, attention is directed to Applicants' specification, at page 14, lines 7 to 21, wherein it is disclosed that the CO oxidation unit is heated to the range of 100 to 250°C while the reforming reaction unit is heated to the range of 400 to 1000°C, so that the temperature difference between them is so large that the temperature control thereof becomes difficult to accomplish. Therefore, Applicants' structure includes that the shift reaction unit and the CO oxidation unit are arranged in a manner that the shift reaction unit and the CO oxidation unit can be indirectly heated by heat transfer from the heat source of the raw material reforming unit. Moreover, the CO oxidation unit can be arranged so as to get cooling of the outside surface by the atmosphere.

Additionally, each of the dependent claims is patentable over the prior art of record in view of the fact that each of these dependent claims includes the limitations of the claims from which they depend. Moreover, each of the dependent claims is patentable over the prior art of record because it would not have been obvious to one having ordinary skill in the art to incorporate such dependent claim features into the invention as more broadly recited in the claims from which they depend. In view of the fact that a prima facie case of obviousness has not been established for independent claim 1, for the sake of brevity, the specific features of each of these dependent claims is not being

individually argued at the present time except for the statement that each of these claims is patentable over the prior art for the combination of features recited therein.

Still further, it is noted that the Office Action has set forth a statement of reasons for allowance. In response, Applicants respectfully submit that the reasons for allowance of the present application are not restricted to the reasons cited by the Examiner. The prior art of record in the present application does not collectively disclose the combination of inventive features recited in each of the claims of the present application. Accordingly, Applicants respectfully submit, for the sole purpose of completing the record, that the reasons for allowance of the present application are not limited to the Examiner's Statement.

Accordingly, the rejections of record should be withdrawn as improper, and all of the claims should be indicated as allowable.

CONCLUSION

In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejection of record, and allow each of the pending claims.

Applicants therefore respectfully request that an early indication of allowance of the application be indicated by the mailing of the Notices of Allowance and Allowability.

Should the Examiner have any questions regarding this Response, the this application, the Examiner is invited to contact the undersigned at the below-listed telephone number.

Respectfully submitted,
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APPENDIX
MARKED UP COPY OF AMENDED CLAIMS 12, 18 and 30

12. (Thrice Amended) A reforming apparatus comprising an integrated structure of three separate units, comprising:

a raw material reforming unit for steam-reforming a raw material to be reformed and producing a reformed gas containing hydrogen as a principal component, including a heat source that generates heat by combustion of a fuel gas, operable to directly obtain heat for the steam reformation reaction from said heat source;

a shift reaction unit for decreasing, by water-gas-shift reaction, CO contained in the reformed gas produced in said raw material reforming unit; and

a CO oxidation unit for further decreasing, by oxidation, CO contained in reformed gas treated in said shift reaction unit;

said raw material reforming unit and said shift reaction unit contain different catalysts, and said shift reaction unit and said CO oxidation unit being arranged in a manner that said shift reaction unit and said CO oxidation unit can be indirectly heated by heat transfer from the heat source of said raw material reforming unit, and further said CO oxidation unit being arranged in a position outside said raw material reforming unit;

said raw material reforming unit comprising a generally cylindrical combustion chamber as the heat source and a reforming reaction unit for steam-reforming the raw material to produce the reformed gas containing hydrogen as a principal component, said reforming reaction unit, said shift reaction unit and said CO oxidation unit are concentrically arranged relative to said combustion chamber; and

further comprising an exhaust chamber, in which a burned exhaust gas from said combustion chamber directly flows, wherein said exhaust chamber is positioned adjacent to and coaxially above said combustion chamber, said shift reaction unit being positioned outside said exhaust chamber, said CO oxidation unit being positioned outside said shift reaction unit.

18. (Thrice Amended) A reforming apparatus comprising an integrated structure of three separate units, comprising:

a raw material reforming unit for steam-reforming a raw material to be reformed and producing a reformed gas containing hydrogen as a principal component, including a heat source that generates heat by combustion of a fuel gas, operable to directly obtain heat for the steam reformation reaction from said heat source;

a shift reaction unit for decreasing, by water-gas-shift reaction, CO contained in the reformed gas produced in said raw material reforming unit; and

a CO oxidation unit for further decreasing, by oxidation, CO contained in reformed gas treated in said shift reaction unit;

said raw material reforming unit and said shift reaction unit contain different catalysts, and said shift reaction unit and said CO oxidation unit being arranged in a manner that said shift reaction unit and said CO oxidation unit can be indirectly heated by heat transfer from the heat source of said raw material reforming unit, and further said CO oxidation unit being arranged in a position outside said raw material reforming unit;

said raw material reforming unit comprising a generally cylindrical combustion chamber as the heat source and a reforming reaction unit for steam-reforming the raw material to produce the

reformed gas containing hydrogen as a principal component, said reforming reaction unit, said shift reaction unit and said CO oxidation unit are concentrically arranged relative to said combustion chamber; and

at least one of said reforming reaction unit, said shift reaction unit and said CO oxidation unit is provided on a surface thereof with a heat transfer material having a higher heat conductivity than that of a material of which said surface is composed.

30. (Thrice Amended) A reforming apparatus comprising an integrated structure of four separate units, which comprises:

a combustion unit for generating heat by combustion of a fuel gas;

a raw material reforming reaction unit for steam-reforming a raw material and producing a reformed gas containing hydrogen as a principal component;

a shift reaction unit for decreasing CO contained in the reformed gas, that was produced in said raw material reforming unit, by water-gas-shift reaction;

a CO oxidation unit for further decreasing CO contained in the resultant reformed gas, that was treated in said shift reaction unit, by oxidation; and

said reforming reaction unit and said shift reaction unit containing different catalysts, said shift reaction unit and said CO oxidation unit being [directly] <u>indirectly</u> heated by heat transfer from the heat source of said raw material reforming unit, said CO oxidation unit being positioned outside said reforming reaction unit, and said reforming reaction unit being directly heated by said combustion unit so that the temperature in said reforming reaction unit is controlled in the range of 400 to 1000°C, said shift reaction unit being indirectly heated by heat transfer from said combustion

unit so that the temperature in said shift reaction unit is controlled in the range of 200 to 350°C, said CO oxidation unit being indirectly heated by heat transfer from said combustion unit so that the temperature in said CO oxidation unit is controlled in the range of 100 to 250°C.